PB-240 338

HUNTINGTON LAKE, SULLIVAN COUNTY, NEW YORK

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center, Las Vegas
New York National Guard
National Environmental Research Center, Corvallis
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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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REPORT
ON
HUNTINGTON LAKE
SULLIVAN COUNTY
NEW YORK

EPA REGION II

WORKING PAPER No. 159

WITH THE COOPERATION OF THE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AND THE

NEW YORK NATIONAL GUARD

DECEMBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the New York Department of Environmental Conservation for professional involvement and to the New York National Guard for conducting the tributary sampling phase of the Survey.

Henry L. Diamond, Commissioner of the New York Department of Environmental Conservation, and Leo J. Hetling, Director, and Italo G. Carcich, Senior Sanitary Engineer, Environmental Quality Research, Department of Environmental Conservation, provided invaluable lake documentation and counsel during the Survey.

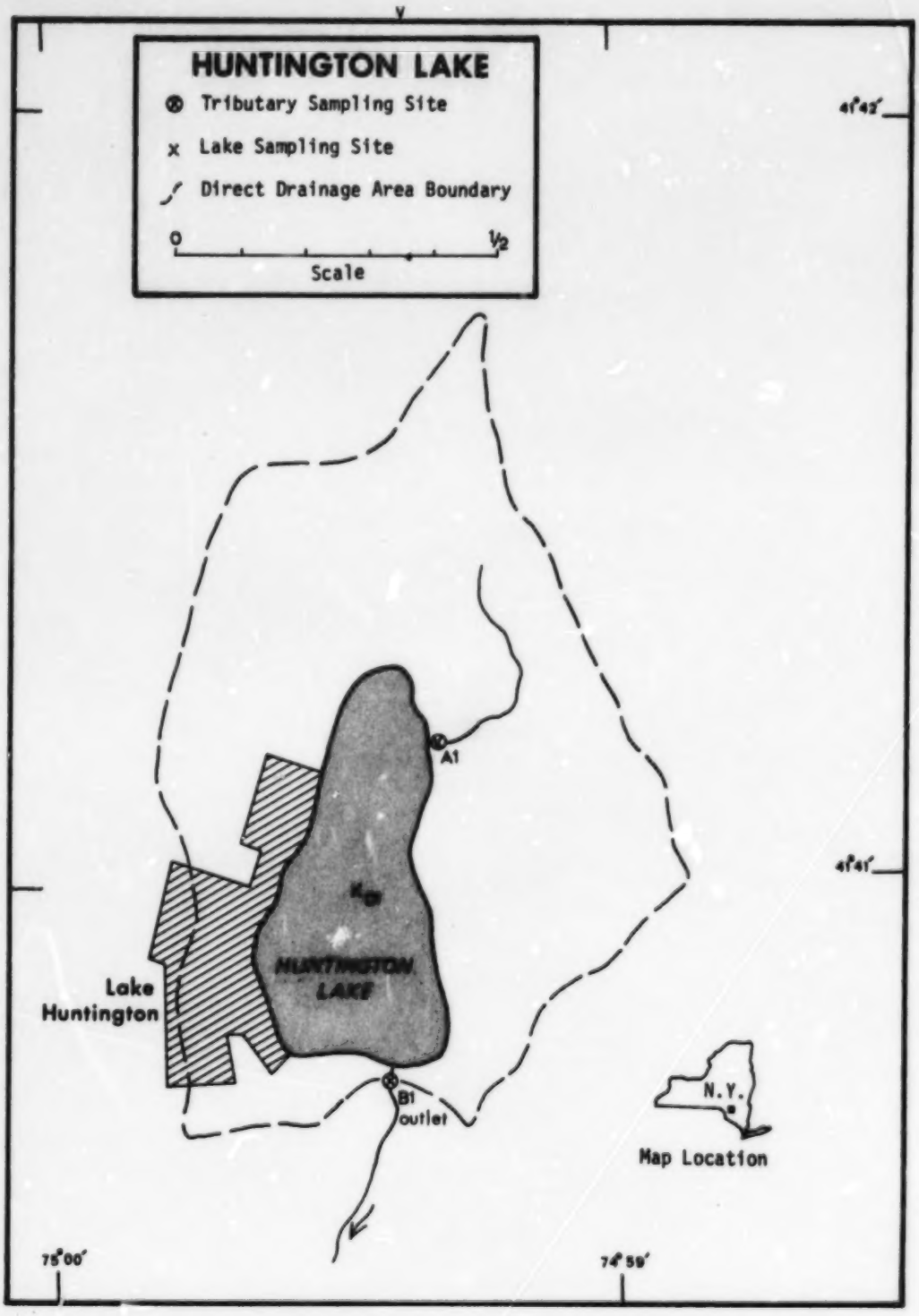
Major General John C. Baker, the Adjutant General of New York, and Project Officer Lieutenant Colonel Fred Peters, who directed the volunteer efforts of the New York National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW YORK

LAKE NAME	COUNTY
Allegheny Reservoir	Cattaraugas, NY; McLean, Warren, PA
Black	St. Lawrence
Canadaigua	Ontario
Cannonsville	Delaware
Carry Falls	St. Lawrence
Cassadaga	Chautauqua
Cayuga	Seneca, Tompkins
Champlain	Clinton, Essex, NY; Addison, Chittenden, Franklin, VT
Chautauqua	Chautauqua
Conesus	Livingston
Cross	Cayuga, Onondaga
Goodyear	Otsego
Huntington	Sullivan
Keuka	Ontario
Long	Hamilton
Lower St. Regis	Franklin
Otter	Cayuga
Owasco	Cayuga
Raquette Pond	Franklin
Round	Saratoga
Sacandaga Res.	Fulton, Saratoga
Saratoga	Saratoga
Schroon	Essex, Warren
Seneca	Seneca, Schyler, Yates
Swan	Sullivan
Swinging Bridge Res.	Sullivan


HUNTINGTON LAKE
Tributary Sampling Site
Lake Sampling Site
Direct Drainage Area Boundary
0
½
Scale
41°42'
41°41'
A1
HUNTINGTON LAKE
Lake Huntington
B1 outlet
N.Y.
Map Location
75°00'
74°59'

LAKE HUNTINGTON

STORET NO. 3615

I. CONCLUSIONS

A. Trophic Condition:

Although Huntington Lake received a very small phosphorus load during the sampling year, survey data indicate that the lake is eutrophic. Of the 26 lakes sampled in the fall of 1972, when essentially all were well-mixed, 10 had less mean total phosphorus, 11 had less mean dissolved phosphorus, and 23 had less inorganic nitrogen. For all New York data, 10 lakes had less mean chlorophyll a, and five lakes had greater Secchi disc transparency.

Near-depletion of dissolved oxygen with depth occurred in July and October.

B. Rate-Limiting Nutrient:

Algal assay results show that Huntington Lake was phosphorus limited at the time the sample was collected. The lake data indicate phosphorus limitation at all sampling occasions; i.e., N/P ratios were always greater than 14/1, and phosphorus limitation would be expected.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Huntington Lake received a total phosphorus load at a rate less than that proposed by Vollenweider (in press) as "permissible"; i.e., an oligotrophic

rate. Of that load, it is estimated that septic tanks contributed about 12%. However, in view of the oligotrophic loading rate, point-source control is not likely to significantly improve the trophic condition of Huntington Lake.

2. Non-point sources (see page 11)--The phosphorus export of the unnamed stream at station A-1 appears to be somewhat higher than the exports of tributaries to nearby Swinging Bridge Reservoir* (mean export of four streams was 59 lbs/mi^2/yr). However, the drainage area at station A-1 is very small (0.2 mi^2) and only a minor change in the total phosphorus loading would result in a sizeable change in the export rate.

In all, it is calculated that non-point sources contributed about 88% of the rather small phosphorus load to the lake.

* Working Paper No. 172.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 83 acres.
2. Mean depth: unknown.
3. Maximum depth: >33 feet.
4. Volume: unknown.
5. Mean hydraulic retention time: unknown.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Unnamed stream (A-1)	0.2 mi^2	0.3 cfs
Minor tributaries & immediate drainage -	0.4 mi^2	0.7 cfs
Totals	0.6 mi^2	1.0 cfs

2. Outlet -

Unnamed stream (B-1)	0.7 mi^2**	1.0 cfs

C. Precipitation:

1. Year of sampling***: 53 inches.
2. Mean annual: 40 inches.

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† Greeson and Robison, 1970.
* Drainage areas are accurate within ±5%, except for small basins (±10%); mean daily flows are accurate within ±5 to 25%; and normalized mean monthly flows are accurate within ±15%.
** Includes area of lake.
*** See Working Paper No. 1, "Survey Methods".

III. LAKE WATER QUALITY SUMMARY

Huntington Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at a single station (see map, page v). During each visit, a single depth-integrated (15 feet to surface) sample was collected for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was taken for algal assays. Also each time, a depth-integrated sample was collected for chlorophyll a analysis. The maximum depth sampled was 33 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		ALL VALUES (10/11/72)		
Temperature (Cent.)	8.7	12.9	14.3	14.4
Dissolved oxygen (mg/l)	0.6	5.0	5.7	8.2
Conductivity (μmhos)	80	86	82	105
pH (units)	6.2	6.4	6.4	6.6
Alkalinity (mg/l)	14	21	14	31
Total P (mg/l)	0.013	0.028	0.015	0.053
Dissolved P (mg/l)	0.007	0.013	0.007	0.024
NO_2 + NO_3 (mg/l)	0.020	0.028	0.020	0.040
Ammonia (mg/l)	0.110	0.780	0.110	1.790
		ALL VALUES		
Secchi disc (inches)	132	138	138	144

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
05/21/72	1. Dinobryon	2,224
	2. Gloeocapsa	524
	3. Scenedesmus	416
	4. Ankistrodesmus	289
	5. Cyclotella	289
	Other genera	327
	Total	4,069
07/07/72	1. Anabaena	246
	2. Gloeocapsa	211
	3. Fragilaria	116
	4. Dinobryon	100
	5. Navicula	85
	Other genera	528
	Total	1,286
10/11/72	1. Anabaena	447
	2. Fragilaria	306
	3. Lyngbya	181
	4. Gloeocapsa	80
	5. Chroococcus	70
	Other genera	382
	Total	1,466

2. Chlorophyll *a* -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
05/21/72	01	1.8
07/07/72	01	9.0
10/11/72	01	8.4

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.016	0.291	2.1
0.010 P	0.026	0.291	6.8
0.020 P	0.036	0.291	7.4
0.050 P	0.066	0.291	11.4
0.050 P + 5.0 N	0.066	5.291	20.4
0.050 P + 10.0 N	0.066	10.291	22.5
10.0 N	0.016	10.291	1.2

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential primary productivity was moderately high at the time the sample was collected. Also, the increased yields with increased orthophosphorus (to about 36 µg/l), and the lack of response when only nitrogen was added, indicates the lake was phosphorus limited.

The lake data indicate phosphorus limitation at all sampling times. The nitrogen to phosphorus ratios were 26 to 1 or greater, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the New York National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of April and May when two samples were collected. Sampling was begun in November, 1972, and was completed in October, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New York District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in lbs/mi^2/year, at station A-1 and multiplying by the ZZ area in mi^2.

Other than septic tanks, there are no known point sources impacting Huntington Lake.

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* See Working Paper No. 1.

A. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed stream (A-1)	20	25.0
b. Minor tributaries & immediate drainage (non-point load) -	40	50.0
c. Known municipal - None	-	-
d. Septic tanks* -	10	12.5
e. Known industrial - None	-	-
f. Direct precipitation** -	10	12.5
Total	80	100.0

2. Outputs -

Lake outlet - Unnamed stream (B-1) 40

3. Net annual P accumulation - 40 pounds

* Estimate based on 22 lakeshore dwellings; see Working Paper No. 1.
** See Working Paper No. 1.

B. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed stream (A-1)	600	19.2
b. Minor tributaries & immediate drainage (non-point load) -	1,200	38.5
c. Known municipal - None	-	-
d. Septic tanks* -	520	16.7
e. Known industrial - None	-	-
f. Direct precipitation** -	800	25.6
Total	3,120	100.0

2. Outputs -

Lake outlet - Unnamed stream (B-1) 1,510

3. Net annual N accumulation - 1,610 pounds

* Estimate based on 22 lakeshore dwellings; see Working Paper No. 1.
** See Working Paper No. 1.

C. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Unnamed stream (A-1)	100	3,000

D. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	0.96	0.48	37.6	19.4
grams/m^2/yr	0.11	0.05	4.2	2.2

Vollenweider loading rates for phosphorus (g/m^2/yr) based on surface area and mean outflow of Huntington Lake:

"Dangerous" (eutrophic rate)	0.32
"Permissible" (oligotrophic rate)	0.16

V. LITERATURE REVIEWED

Greeson, Phillip E., and F. Luman Robison, 1970. Characteristics of New York lakes. Part 1 - Gazetter of lakes, ponds, and reservoirs. Bull. 68, U.S. Dept. Int. and NY Dept. Env. Cons., Albany.

Vollenweider, Richard A. (in press). Input-output models. Schweiz. A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW YORK 11/26/75

LAKE CODE 3615 HUNTINGTON LAKE

TOTAL DRAINAGE AREA OF LAKE 0.70

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3615A1	0.19	0.29	0.31	0.58	0.64	0.35	0.15	0.09	0.11	0.07	0.11	0.21	0.28	0.27
361581	0.70	1.08	1.15	2.14	2.35	1.30	0.55	0.34	0.41	0.27	0.41	0.78	1.01	0.98
3615ZZ	0.51	0.79	0.84	1.56	1.71	0.95	0.40	0.25	0.30	0.19	0.30	0.57	0.73	0.71

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 0.70
SUM OF SUB-DRAINAGE AREAS = 0.70
TOTAL FLOW IN = 11.78
TOTAL FLOW OUT = 11.79

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3615A1	11	72	0.48	4	0.10				
	12	72	0.41	2	0.30				
	1	73	0.21	6	0.21				
	2	73	0.18	3	0.78	4	0.62		
	3	73	0.21	3	0.09				
	4	73	0.45	7	0.64	21	0.14		
	5	73	0.41	5	0.14	18	1.78		
	6	73	0.25	2	0.16				
	7	73	0.12	7	0.11				
	8	73	0.17	4	0.34				
	9	73	0.05	7	0.05				
	10	73	0.05	6	0.05				
361581	11	72	3.49	4	0.68				
	12	72	2.95	2	2.14				
	1	73	1.54	6	1.51				
	2	73	1.28	3	5.60	4	4.46		
	3	73	1.33	3	0.68				
	4	73	2.88	7	4.01	21	0.91		
	5	73	2.61	5	0.88	20	11.40		
	6	73	3.75	2	2.43				
	7	73	1.86	7	1.68				
	8	73	5.70	4	11.50				
	9	73	1.31	7	1.35				
	10	73	1.23	6	1.48				
3615ZZ	11	72	3.01						
	12	72	2.54						
	1	73	1.33						
	2	73	1.10						
	3	73	1.12						
	4	73	2.43						
	5	73	2.28						
	6	73	3.50	2	2.27				
	7	73	1.74	7	1.57				
	8	73	5.53	4	11.20				
	9	73	1.26	7	1.30				
	10	73	1.18	6	1.43				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/11/26

361501
41 40 58.0 074 59 27.0
HUNTINGTON LAKE
36 NEW YORK

11EPALES
3

2111202
0020 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/05/21	14 00	0000	17.7	8.9	144	60	7.30	10K	0.200	0.060	0.014	0.003
	14 00	0006	16.8	9.7		80	7.30	11	0.210	0.030	0.013	0.013
	14 00	0016	9.4	10.6		80	6.60	13	0.260	0.030	0.032	0.015
72/07/22	12 20	0000			132	80	7.80	14	0.040	0.060	0.012	0.008
	12 20	0004	28.0	7.4		80	7.90	14	0.040	0.080	0.012	0.008
	12 20	0015	18.5	9.0		80	7.90	16	0.180	0.120	0.021	0.013
	12 20	0020	13.3	4.2		90	6.50	16	0.180	0.120	0.018	0.010
	12 20	0033	6.8	0.4		100	6.60	27	0.040	0.810	0.059	0.018
72/10/11	16 30	0000				83	6.30	14	0.020	0.110	0.015	0.007
	16 30	0004	14.4	8.1		80	6.50	14	0.020	0.110	0.016	0.007
	16 30	0015	14.4	8.2		80	6.55	14	0.020	0.110	0.013	0.007
	16 30	0020	14.2	3.3		82	6.40	31	0.040	1.790	0.053	0.020
	16 30	0028	8.7	0.6		105	6.20	30	0.040	1.790	0.047	0.024

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/05/21	14 00	0000	1.8J
72/07/22	12 20	0000	9.0J
72/10/11	16 30	0000	8.4J

K VALUE KNOWN TO BE LESS THAN INDICATED

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/11/26

3615A1 LS3615A1
41 41 00.0 074 59 30.0
UNNAMED BROOK
36077 7.5 LK HUNTINGTO
T/LAKE HUNTINGTON
BRDG ALONG NE PART OF LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	14 00		0.670	0.480	0.105	0.019	0.021
72/12/02	13 15		0.371	0.260	0.031	0.015	0.026
73/01/06	11 20		0.378	0.340	0.024	0.011	0.017
73/02/03	13 05		0.240	0.240	0.060	0.016	0.040
73/03/03	12 20		0.340	0.270	0.092	0.019	0.045
73/04/07	14 00		0.294	3.360	0.095	0.014	0.035
73/04/21	14 00		0.350	0.860	0.089	0.028	0.050
73/05/05	11 00		0.280	0.400	0.092	0.058	0.080
73/05/18	15 00		0.154	0.850	0.210	0.016	0.025
73/06/02	14 30		0.132	0.960	0.073		0.040
73/07/07	14 45		0.290	1.200	0.038	0.016	0.040
73/08/04	14 30		0.230	0.440	0.028	0.024	0.035
73/09/07	15 00		0.550	1.600	0.123	0.026	0.040
73/10/06	15 15		0.390	0.560	0.090	0.028	0.045

STORET RETRIEVAL DATE 74/11/26

361581 LS361581
41 40 30.0 074 59 30.0
UNNAMED BROOK
36 7.5 LK HUNTINGTO
O/LAKE HUNTINGTON
BUFF RD BRDG SE OF TOWN OF HUNTINGTON LK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	14 05		0.051	0.330	0.047	0.005K	0.160
72/12/02	13 25		0.110	0.630	0.160	0.005K	0.016
73/01/06	11 25		0.150	0.480	0.100	0.005K	0.014
73/02/03	13 15		0.190	0.380	0.115	0.005K	0.015
73/03/03	12 30		0.220	0.500	0.138	0.005K	0.016
73/04/07	14 20		0.230		0.140	0.005K	0.030
73/04/21	14 20		0.198	1.100	0.046	0.005K	0.015
73/05/05	11 05		0.189	0.780	0.050	0.009	0.015
73/05/18	15 50		0.160	0.380	0.012	0.005K	0.015
73/06/02	15 00		0.120		0.126	0.011	0.030
73/07/07	15 00		0.010K	1.150	0.039	0.005K	0.015
73/08/04	14 40		0.022	0.500	0.006	0.007	0.015
73/10/06	15 30		0.033	0.690	0.060	0.012	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED